Searches for User *gphilippe* (Count = 8678)

Queries 17257 through 17306.

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S #	Updt	Database	Query	Time	Comment
S8678	U	PGPB,USPT,EPAB,JPAB,DWPI	extract$3 and (double or two or twice) and (feature quantity or pattern$1 or characteristic$1) and ((vertical$2 same frame$1 same field$1) same scene change$1)	2004-02-23 12:25:06	
S8677	U	PGPB,USPT,EPAB,JPAB,DWPI	(double or two or twice) and (feature quantity or pattern$1 or characteristic$1) and ((vertical$2 same frame$1 same field$1) same scene change$1)	2004-02-23 12:23:29	
S8676	U	PGPB,USPT,EPAB,JPAB,DWPI	(feature quantity or pattern$1 or characteristic$1) and ((vertical$2 same frame$1 same field$1) same scene change$1)	2004-02-23 12:20:32	
S8675	U	PGPB,USPT,EPAB,JPAB,DWPI	feature quantity and ((vertical$2 same frame$1 same field$1) same scene change$1)	2004-02-23 12:19:03	

S8674	U	PGPB,USPT,EPAB,JPAB,DWPI	((vertical$2 same frame$1 same field$1) same scene change$1)	2004-02-23 12:18:47
S8673	U	PGPB,USPT,EPAB,JPAB,DWPI	scene change$1 and ((vertical$2 same frame$1 same field$1) same feature quantity)	2004-02-23 12:18:12
S8672	U	PGPB,USPT,EPAB,JPAB,DWPI	((vertical$2 same frame$1 same field$1) same feature quantity)	2004-02-23 12:16:32
S8671	U	PGPB,USPT,EPAB,JPAB,DWPI	((scene change$1 same vertical$) same compar$3) and feature$1	2004-02-23 12:15:08
S8670	U	PGPB,USPT,EPAB,JPAB,DWPI	(frame$1 same field$1) and (compress$3 near4 (moving picture$1 or video or image$1)) and ((scene change$1 with interval$1) and start$3 and end$3)	2004-02-23 10:52:27
S8669	U	PGPB,USPT,EPAB,JPAB,DWPI	(compress$3 near4 (moving picture$1 or video or image$1)) and ((scene change$1 with interval$1) and start$3 and end$3)	2004-02-23 10:51:47
S8668	U	PGPB,USPT,EPAB,JPAB,DWPI	((scene change$1 with interval$1) and start$3 and end$3)	2004-02-23 10:49:27
S8667	U	PGPB,USPT,EPAB,JPAB,DWPI	((number near3 blocks near3 dct) same (scene change with field$1))	2004-02-23 10:29:54
S8666	U	PGPB,USPT,EPAB,JPAB,DWPI	((scene near3 chang$3) same feature quantity) and field$1 and	2004-02-19 19:11:10

			frame$1 and (select$3 or judg$3)	
S8665	U	PGPB,USPT,EPAB,JPAB,DWPI	((extract$3 with feature quantity) same field$1) and (scene near3 change$1)	2004-02-19 19:09:00
S8664	U	PGPB,USPT,EPAB,JPAB,DWPI	(field$1 and frame$1) and ((scene with chang$3) same feature near3 quantity and extract$3)	2004-02-19 17:37:00
S8663	U	PGPB,USPT,EPAB,JPAB,DWPI	((scene with chang$3) same feature near3 quantity and extract$3)	2004-02-19 17:32:42
S8662	U	PGPB,USPT,EPAB,JPAB,DWPI	((scene near3 chang$3) same feature near3 quantity near4 extract$3)	2004-02-19 17:31:41
S8661	U	PGPB,USPT,EPAB,JPAB,DWPI	((scene$1 near4 change$1) same feature quantity same extract$3)	2004-02-19 17:30:11
S8660	U	PGPB,USPT,EPAB,JPAB,DWPI	((control$4 near4 decoding) same (discriminat$ with security data))	2004-02-19 13:50:41
S8659	U	PGPB,USPT,EPAB,JPAB,DWPI	security and discriminat$ and ((security near3 data) same (control$3 near4 decod$3))	2004-02-19 13:37:05
S8658	U	PGPB,USPT,EPAB,JPAB,DWPI	((security near3 data) same (control$3 near4 decod$3))	2004-02-19 13:36:44
S8657	U	PGPB,USPT,EPAB,JPAB,DWPI	(security near3 data) and (control$3 near4 decod$3)	2004-02-19 13:36:19
S8656	U	PGPB,USPT,EPAB,JPAB,DWPI	(discrimat$3 same security near4	2004-02-19

			data) same (decoding or decompres$4)	13:35:41
S8655	U	PGPB,USPT,EPAB,JPAB,DWPI	(discrimat$3 same security near4 data) and (control$3 with (decoding or decompres$4))	2004-02-19 13:34:47
S8654	U	PGPB,USPT,EPAB,JPAB,DWPI	(discrimat$3 with security data) and (control$3 with (decoding or decompres$4))	2004-02-19 13:33:59
S8653	U	PGPB,USPT,EPAB,JPAB,DWPI	(discrimat$3 with security data) and (control$3 near4 (decoding or decompres$4))	2004-02-19 13:33:42
S8652	U	PGPB,USPT,EPAB,JPAB,DWPI	(discrimat$3 with security data) and (control$ near4 (decoding or decompres$4))	2004-02-19 13:33:03
S8651	U	PGPB,USPT,EPAB,JPAB,DWPI	(security with discrimination with encod$3) and (control$3 near4 decod$3)	2004-02-19 13:22:46
S8650	U	PGPB,USPT,EPAB,JPAB,DWPI	(boundary near3 line$1 near4 court$1) and sport$3 and frame and ball$1 and out	2004-02-19 12:05:43
S8649	U	PGPB,USPT,EPAB,JPAB,DWPI	(boundary near3 line$1 near4 court$1) and sport$3 and frame near4 grab$3 and ball$1 and out	2004-02-19 12:04:25
S8648	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(buffer$1 or memor$3 or stor$3) and (interpolat$ near4 (bi-linear or bilinear or bi linear$3)) and (pixel$1 near4 position$2) and	2004-02-18 16:28:29

			(partition$ or divid$3 or separat$3) and ((half-pixel$1 or halfpixel$1) same (motion with interpolat$))	
S8647	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(interpolat$ near4 (bi-linear or bilinear or bi linear$3)) and (pixel$1 near4 position$2) and (partition$ or divid$3 or separat$3) and ((half-pixel$1 or halfpixel$1) same (motion with interpolat$))	2004-02-18 16:25:17
S8646	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(pixel$1 near4 position$2) and (partition$ or divid$3 or separat$3) and ((half-pixel$1 or halfpixel$1) same (motion with interpolat$))	2004-02-18 16:24:05
S8645	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(partition$ or divid$3 or separat$3) and ((half-pixel$1 or halfpixel$1) same (motion with interpolat$))	2004-02-18 16:23:03
S8644	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	((half-pixel$1 or halfpixel$1) same (motion with interpolat$))	2004-02-18 16:21:40
S8643	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	((half-pixel$1 or halfpixel$1) same (motion near4 interpolat))	2004-02-18 16:21:21
S8642	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	((half-pixel$1 or halfpixel$1) with (motion interpolat))	2004-02-18 16:20:57
S8641	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	((half pixel$1)	2004-

			with (motion interpolat))	02-18 16:20:23
S8640	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	((half near4 pixel$1) with (motion near4 interpolat))	2004-02-18 16:19:54
S8639	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	((half near4 pixel$1) with (motion near4 interpolat)) and (buffer$ or memory or stor$3) and (partition$3 or separat$3 or divid$3) and (interpolat$ near4 pixel$1) and half pixel$1 and motion estimat$ and motion and (half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:19:43
S8638	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(buffer$ or memory or stor$3) and (partition$3 or separat$3 or divid$3) and (interpolat$ near4 pixel$1) and half pixel$1 and motion estimat$ and motion and (half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:18:30
S8637	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(partition$3 or separat$3 or divid$3) and (interpolat$ near4 pixel$1) and half pixel$1 and motion estimat$ and motion and (half near3	2004-02-18 16:17:38

			pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	
S8636	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(interpolat$ near4 pixel$1) and half pixel$1 and motion estimat$ and motion and (half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:16:44
S8635	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	half pixel$1 and motion estimat$ and motion and (half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:15:53
S8634	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	half pixel$1 and (partition$3 same interpolat$ near4 pixel$1 same (stor$3 or buffer$1 or memor$3)) and motion estimat$ and motion and (half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:15:41
S8633	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(partition$3 same interpolat$ near4 pixel$1 same (stor$3 or buffer$1 or memor$3)) and motion estimat$ and motion and (half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:15:15

S8632	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	motion estimat$ and motion and (half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:14:43
S8631	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	motion and (half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:14:33
S8630	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(half near3 pixel$1) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:14:01
S8629	U	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	(partition$3 same interpolat$ near4 pixel$1 same (stor$3 or buffer$1 or memor$3)) and ((half near3 pixel$1) with (motion near4 estimat$))	2004-02-18 16:13:20

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L2: Entry 11 of 12 File: USPT Jun 24, 1997

DOCUMENT-IDENTIFIER: US 5642239 A
TITLE: Methods and apparatus for changing the repetition rate of image data, and for detecting still images and scene changes in image data

Brief Summary Text (11):
In accordance with a further aspect of the present invention, an apparatus and a method of detecting a scene change within image data including a sequence of field or frame image data intervals are provided, each of the image data intervals being in the form of a plurality of blocks which have been transformed by discrete cosine transformation. The apparatus and the method comprise the means for and the steps of, respectively: obtaining a direct current component of each of a plurality of blocks of a first image data interval; obtaining a direct current component of each of a plurality of blocks of a second image data interval next following the first image data interval in the sequence; comparing the direct current components of corresponding blocks of the first and second image data intervals to determine an equivalence of such corresponding blocks; producing first sum data representing a number of the corresponding blocks of the first and second image data intervals that are equivalent; obtaining a direct current component of each of a plurality of blocks of a third image data interval next following the second image data interval in the sequence; comparing the direct current components of corresponding blocks of the second and third image data intervals to determine an equivalence of such corresponding blocks; producing second sum data representing a number of the corresponding blocks of the second and third image data intervals that are equivalent; determining a difference between the first and second sum data; and producing a scene change detection signal when the difference between the first and second sum data exceeds a predetermined threshold value.

Detailed Description Text (6):
The data D1 supplied by the ECC decoder 11 is also input to a still picture detecting circuit 15. When the still picture detecting circuit 15 determines that the fields of the data D1 represent a still picture, it outputs a still picture detection signal S2 to the frame synchronizer 12 via an adding circuit 17. The data D1 is also supplied by the ECC decoder 11 to a scene change detecting circuit 16. The circuit 16 detects when a scene change in the sequence of fields of the data D1 has occurred, whereupon it supplies a scene change detection signal S3 to the frame synchronizer 12 via the adding circuit 17.

Detailed Description Text (21):
A signal indicating the result of each comparison is output by the circuit 42 to a circuit 43 which detects a sum of equivalent blocks for each pair of fields, that is, the current field and the next preceding field. This sum, indicated as N, is supplied by the circuit 43 both to a first input of a judgement circuit 44 and to a circuit 45 which stores the sum N for one field interval and then outputs the delayed sum as data N' to a second input of the judgement circuit 44. The judgement circuit 44 calculates a difference ΔN between the sum N of equivalent blocks in the present field and next preceding field, and the sum N' of equivalent blocks in the next preceding field and the field next preceding that field, and then determines whether the difference .DELTA.N is greater than a predetermined constant value. If so, the judgement circuit 44 determines that a scene change has occurred between the current field and the next preceding field and responds by producing a scene

change detection signal S3 which is supplied to the frame synchronizer 12 via the adding circuit 17.

Detailed Description Text (22):
The scene change detecting process carried out by the circuit 16 is performed for each field in real time.

Detailed Description Text (23):
In the event that the field repetition rate of the reproduced image data D1 differs from the predetermined output field repetition rate, when the scene change detection signal S3 is received by the frame synchronizer 12, it responds by either omitting or adding a field as may be necessary in order to produce the desired output field repetition rate of the image date D2.

Detailed Description Text (24):
FIG. 7 is a schematic diagram for illustrating one mode of operation for the scene change detection circuit of FIG. 6. A sequence of fields A1 through A5 followed by B1 through B5 of the image data D1 is illustrated at (A) of FIG. 7, while the image data D1' output by the memory 46 is illustrated at (B) of FIG. 7. In this illustration, it is assumed that the fields A1 through A5 represent either still pictures or a continuous set of images in which there is motion, while the sequence of fields B1 through B5 also represents a sequence of still pictures or a continuous set of images in which there is motion, but that a scene change occurs between the fields A5 and B1.

Detailed Description Text (25):
The number of equivalent blocks N.sub.n between each field of the sequence D1 representing a current field and the next preceding field of the sequence D1' is represented at (C) of FIG. 7. Because of the scene change between the fields A5 and B1, the sum N of equivalent blocks when these two fields are compared and as output by the circuit 43 of FIG. 6 is a relatively small value. However, the result of each of the remaining comparisons as illustrated in FIG. 7 will yield a sum N.sub.n which is substantially larger than the sum of equivalent blocks N.sub.5. Accordingly, when the judgement circuit 44 determines the difference between each sum N (represented by the sequence (C) of FIG. 7) and the one field delayed sum N' (represented as sequence (D) in FIG. 7) the result .DELTA. N.sub.4 (see sequence (E) in FIG. 7) will be relatively large, while the remaining values .DELTA. N.sub.n will be relatively much smaller.

Detailed Description Text (26):
The predetermined constant employed by the judgement circuit 44 against which each of the values .DELTA. N is compared is selected so that the values of .DELTA. N.sub.n obtained upon a scene change is larger than the predetermined constant, while values of .DELTA. N.sub.n occurring when fields representing still pictures or continuous motion are compared are less than the predetermined constant. In this manner, the judgement circuit 44 is able to determine when a scene change has occurred by detecting when the value .DELTA. N.sub.n (for example, .DELTA. N.sub.4 in FIG. 7) is greater than the predetermined constant. When this occurs, the judgement circuit 44 outputs the scene change detection signal S3 which it supplies to the frame synchronizer 12 via the adding circuit 17, so that the synchronizer 12 can then, if appropriate, either omit or add a field in order to conform the field repetition rate of the image data D2 to the predetermined output rate.

Detailed Description Text (27):
Referring now to FIG. 8, an occurrence of the scene change detection signal S3 is illustrated at (A) as a function of 5 time, indicating that a scene change has occurred between fields F2 and F3 of the image data D1 illustrated schematically at (B) of FIG. 8. In this illustration, it is assumed that the field repetition rate of the field sequence D2 (see sequence (C) in FIG. 8) during the time interval illustrated in FIG. 8 is relatively lower than that of the image data D1, so that

during this interval seven fields of the image data D2 must be output by the frame synchronizer 12 while eight fields of the image data D1 are received thereby. Accordingly, upon the occurrence of the scene change detection signal S3, the frame synchronizer 12 in one mode of operation omits the field F3 which occurs at the point of the scene change. An advantage of this mode of operation is that memory requirements are minimized. However, where sufficient memory is available, in a different mode of operation the field F2 is omitted in place of the field F3 since the field F2 also occurs at the scene change.

Detailed Description Text (28):
Conversely, when the field repetition rate of the image data D2 is greater than that of the image data D1, upon a scene change a field occurring at that point can be output twice by the frame synchronizer 12 in order to conform the field repetition rate of the output image data D2 with the predetermined output field repetition rate. An illustration of this mode of operation is provided in FIG. 9 wherein it is assumed that during the illustrated time period seven fields of the image data D1 are received by the frame synchronizer 12 (sequence (B)), while it must output eight fields of the image data D2 (sequence (C)) in order to conform its field repetition rate to the predetermined output rate. It is also assumed that a scene change occurs between the fields F2 and F3 of the image data D1. Accordingly, the scene change detection circuit 16 outputs the scene change detection signal S3 at the field interval F3 indicating the occurrence of the scene change, and the frame synchronizer 12 responds in one mode of operation by outputting the field F3 twice in order to produce the image data D2 output thereby. While this mode of operation minimizes the required memory capacity, where sufficient memory is available in another mode of operation the frame synchronizer 12 instead outputs the field F2 twice in order to produce the image data D2.

Detailed Description Text (32):
In the embodiments of the invention as described above, image date which has been DCT-transformed and recorded on the magnetic tape 23 is reproduced by the apparatus 10, and the DC components of corresponding blocks of successive fields are compared to determine whether they are equivalent. The sum N of equivalent DCT blocks produced by comparing the successive fields provides a basis to determine whether there is a correlation between the images represented by the compared fields. If so, this indicates that either there is substantially no movement in such images (that is, they are still pictures) or else they represent a continuous groups of images. The apparatus 10 is then able to synchronize the reproduced image data with the predetermined output field repetition rate by selectively omitting or adding fields representing a succession of still pictures or at the boundaries of scene changes, so that apparent discontinuities in the reproduced images that would result from a random omission or addition of fields as in the prior art is avoided.

CLAIMS:

6. The apparatus of claim 5, wherein the image data is in the form of a sequence of image data intervals each comprising a plurality of discrete cosine transformed (DCT) blocks each including at least a DC component, and wherein the correlation determining means is operative to compare DC components of spatially corresponding DCT blocks of the first and second image data intervals to produce said correlation value as a number of the spatially corresponding DCT blocks having equivalent DC components.

13. The apparatus of claim 12, wherein the image data is in the form of a sequence of image data intervals each comprising a plurality of discrete cosine transformed (DCT) blocks each including at least a DC component, and wherein the correlation determining means is operative to compare DC components of spatially corresponding DCT blocks of the first and second image data intervals and the second and third image data intervals in order to produce the first and second correlation values,

respectively, as numbers of the spatially corresponding DCT blocks having equivalent DC components.

24. An apparatus for detecting a scene change within image data including a sequence of field or frame image data intervals each in the form of a plurality of blocks which have been transformed by discrete cosine transformation, comprising:

means for obtaining a direct current component of each of a plurality of blocks of a first image data interval;

means for obtaining a direct current component of each of a plurality of blocks of a second image data interval next following the first image data interval in the sequence;

first comparing means for comparing the direct current components of corresponding blocks of the first and second image data intervals to determine an equivalence of such corresponding blocks;

means for producing first sum data representing a number of the corresponding blocks of the first and second image data intervals that are equivalent;

means for obtaining a direct current component of each of a plurality of blocks of a third image data interval next following the second image data interval in the sequence;

second comparing means for comparing the direct current components of corresponding blocks of the second and third image data intervals to determine an equivalence of such corresponding blocks;

means for producing second sum data representing a number of the corresponding blocks of the second and third image data intervals that are equivalent;

means for determining a difference between the first and second sum data; and

means for producing a scene change detection signal when the difference between the first and second sum data exceeds a predetermined threshold value.

26. A method of detecting a scene change within image data including a sequence of field or frame image data intervals each in the form of a plurality of blocks which have been transformed by discrete cosine transformation, comprising the steps of:

obtaining a direct current component of each of a plurality of blocks of a first image data interval;

obtaining a direct current component of each of a plurality of blocks of a second image data interval next following the first image data interval in the sequence;

comparing the direct current components of corresponding blocks of the first and second image data intervals to determine an equivalence of such corresponding blocks;

producing first sum data representing a number of the corresponding blocks of the first and second image data intervals that are equivalent;

obtaining a direct current component of each of a plurality of blocks of a third image data interval next following the second image data interval in the sequence;

comparing the direct current components of corresponding blocks of the second and third image data intervals to determine an equivalence of such corresponding blocks;

producing second sum data representing a number of the corresponding blocks of the second and third image data intervals that are equivalent;

determining a difference between the first and second sum data; and

producing a scene change detection signal when the difference between the first and second sum data exceeds a predetermined threshold value.

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L2: Entry 12 of 12 File: USPT Jun 10, 1997

DOCUMENT-IDENTIFIER: US 5638124 A

TITLE: Video signal processing apparatus having an image inserting and extracting circuit for inserting an image into or extracting an image from video signal based on a detected result of a motion detecting circuit

Detailed Description Text (23):

The memory control circuit 17 controls the memory 11 by switching the image insertion and extraction frame processing unit 40 and the image insertion and extraction field processing unit 41 on the basis of the detected result input thereto from the scene change detecting and motion detecting circuit 16. Specifically, the memory control circuit 17 selects the field processing unit 41 when the input detected result indicates that an image is a moving picture and selects the frame processing unit 40 when the detected result indicates that an image has a scene change or that an image is a still picture.

Detailed Description Text (29):

The energy ratio calculating unit 52 calculates an energy ratio between the DC component and the AC component of the field j of the image signal supplied thereto from the DCT block 14. If an image has a relatively simple picture pattern, then an energy of DC component of image data becomes relatively large. If on the other hand an image has a relatively complex picture pattern, then an energy of DC component of image data becomes relatively small. Therefore, the DCT block 14 increases the number of bits assigned to the DC component when the energy of DC component is relatively large, and decreases the number of bits assigned to the DC component when the energy of DC component is relatively small. According to this embodiment, the DCT block 14 changes the number of bits assigned to the DC component in a range of from 10 bits to 14 bits in accordance with a magnitude of DC component, i.e., simplicity of picture pattern of image. Therefore, according to this embodiment, it is possible to simply calculate the energy ratio (ratio between DC component value and AC component value) of DC component and AC component of image data supplied from the DCT block 14 or it is possible to detect the number of bits assigned to the DC component. The detection level .alpha. calculating unit 53 calculates the detection level .alpha. based on a detected result of the energy ratio calculating unit 52.

Detailed Description Text (35):

While the scene change detecting and motion detecting circuit 16 detects a motion of an image at the field unit as described above, the present invention is not limited thereto and the scene change detecting and motion detecting circuit 16 may detect a motion of an image at the frame unit.

Detailed Description Text (41):

When the dynamic control mode is selected by the switch 43 after the operator has depressed the button disposed on the control panel (not shown) of the video signal processing apparatus, if the dynamic control signal of low "L" level is supplied to the memory control circuit 17 from the scene change detecting and motion detecting circuit 16, then the switch 42 selects the field processing unit 41.

L5: Entry 8 of 22 File: USPT Jan 8, 2002

DOCUMENT-IDENTIFIER: US 6337879 B1
TITLE: Video data compression apparatus and method of same

Abstract Text (1):
A video data compression apparatus with which compressed video data of suitable amounts of data can be produced and in addition the time required for processing is short. An encoder control unit performs a preprocessing for compression and coding and, at the same time, produces a flatness and an intra AC as parameters indicating the difficulty of the pattern of pictures to be compressed to I pictures. A motion detector calculates a predictive error amount (ME residual) of the motion prediction. An FIFO memory delays each picture of the input video data. A host computer approximates a real difficulty data D.sub.j indicating the difficulty of the pattern of each picture by the ME residual, flatness, and intra AC and further calculates the target amount of data T.sub.j of the compressed video data from the approximated real difficulty data D.sub.j. The encoder performs the compression and coding so that the amount of data of the compressed video data becomes substantially the target amount of data T.sub.j.

Brief Summary Text (3):
The present invention relates to a video data compression apparatus for compressing and coding noncompressed video data and a method of same.

Brief Summary Text (5):
When compressing and coding noncompressed digital video data in units of GOPs (groups of pictures) comprised of an I picture (intra-coded picture), a B picture (bi-directionally predictive coded picture), and a P picture (predictive coded picture) by a method such as the MPEG (Moving Picture Experts Group) and recording the same on a recording medium such as a magneto-optical disc (MO disc) or transmitting the same via communication line, it is necessary to control the amount of data (amount of bits) of the compressed video data after the compression and coding to be not more than the recording capacity of the recording medium or not more than the transmission capacity of the communication line while holding the quality of the image after expansion and decoding high.

Brief Summary Text (6):
For this purpose, first, there is adopted a method of preliminarily compressing and coding the noncompressed video data to estimate the amount of data after the compression and coding (first pass), then adjusting the compression rate based on the estimated amount of data and performing the compression and coding so that the amount of data after the compression and coding becomes not more than the recording capacity of the recording medium by (second pass) (hereinafter, such a compression and coding method will be also referred to as "two pass encoding").

Brief Summary Text (7):
However, if performing the compression and coding by the two pass encoding, it is necessary to apply similar compression and coding processing two times with respect to the same noncompressed video data, so a long time is taken. Further, since the final compressed video data cannot be calculated by one compression and coding processing, the shot video data cannot be compressed, coded, recorded, or transmitted in real time as it is.

Brief Summary Text (9):
An object of the present invention is to provide a video data compression apparatus with which the audio and/or video data can be compressed and coded to a predetermined amount of data or less not by the two pass encoding and a method of the same.

Brief Summary Text (10):
Further, another object of the present invention is to provide a video data compression apparatus with which the video data can be compressed and coded in almost real time and in addition with which a high quality image can be obtained after the expansion and decoding and a method of the same.

Brief Summary Text (11):
Further, still another object of the present invention is to provide a video data compression apparatus with which the compression and coding processing can be carried out by adjusting the compression rate by estimating the amount of data after the compression and coding not by the two pass encoding and a method of the same.

Brief Summary Text (12):
According to a first aspect of the present invention, there is provided a video data compression apparatus having an indicator data calculating means for calculating indicator data indicating a complexity of video data for every picture from noncompressed video data; a target value calculating means for calculating a target value of an amount of data after compression of the video data for every picture based on the calculated indicator data; and a compressing means for compressing the noncompressed video data so that the amount of data after compression becomes the calculated target value.

Brief Summary Text (13):
According to a second aspect of the present invention, there is provided a data compression method comprising the steps of calculating indicator data indicating a complexity of video data for every picture from noncompressed video data; calculating a target value of an amount of data after compression of the video data for every picture based on the calculated indicator data; and compressing the video data by a predetermined compression method so that the amount of data after compression becomes the calculated target value.

Brief Summary Text (14):
According to a third aspect of the present invention, there is provide a video data compression apparatus having an indicator data calculating means for calculating indicator data indicating a complexity of video data for every picture; a difficulty data calculating means for performing a predetermined computation processing for multiplying a coefficient with the calculated indicator data to calculate difficulty data corresponding to the amount of data after compression of the video data; a target value calculating means for calculating a target value of the amount of data after compression of the video data for every picture based on the calculated difficulty data; a compressing means for compressing each of the pictures of the video data by a predetermined compression method so that the amount of data after compression becomes the calculated target value so as to generate compressed video data; and a coefficient updating means for updating the coefficient based on the amount of data of the generated compressed video data.

Brief Summary Text (15):
According to a fourth aspect of the present invention, there is provided a video data compression method comprising the steps of calculating indicator data indicating a complexity of video data for every picture; performing predetermined computation processing for multiplying a coefficient with the calculated indicator data to calculate difficulty data corresponding to the amount of data after

compression; calculating a target value of the amount of data after compression of the noncompressed video data for every picture based on the calculated difficulty data; compressing each of the pictures of the video data by the compression method so that the amount of data after compression becomes the calculated target value so as to generate compressed video data; and updating the coefficient based on the amount of data of the generated compressed video data.

Brief Summary Text (16):
According to a fifth aspect of the present invention, there is provided a video data compression apparatus for compressing a continuous plurality of video data to compressed video data of a picture type sequence containing a plurality of types of pictures (I picture, P picture, and B picture) in a predetermined order, having a rearranging means for rearranging pictures of the noncompressed video data to an order adapted to the compression method so that each head picture of the video data becomes an I picture or a P picture; an indicator data calculating means for calculating indicator data indicating a complexity of the rearranged noncompressed video data for every picture; a border detecting means for detecting a scene change of a continuous plurality of the noncompressed video data; a changing means for changing the picture type sequence so that pictures of any of the noncompressed video data are compressed without reference to the pictures of the other noncompressed video data for every border of a detected scene change; a target value calculating means for calculating a target value of the amount of data after compression of the video data based on the calculated indicator data and the picture type sequence after change; and a compressing means for compressing the video data to compressed video data of the picture type sequence after change so that the amount of data after compression becomes substantially the calculated target value.

Brief Summary Text (17):
According to a sixth aspect of the present invention, there is provided a video data compression method for compressing a continuous plurality of video data to compressed video data of a picture type sequence containing a plurality of types of pictures (I picture, P picture, and B picture) in a predetermined order, comprising the steps of rearranging pictures of the noncompressed video data to an order adapted to the compression method so that each head picture of the video data becomes an I picture or a P picture; calculating indicator data indicating a complexity of the rearranged noncompressed video data for every picture; detecting a scene change of the continuous plurality of the noncompressed video data; changing the picture type sequence so that a picture of any of the noncompressed video data is compressed without reference to a pictures of other noncompressed video data for every border of a detected scene change; calculating a target value of the amount of data after compression of the video data for every predetermined compression unit based on the calculated indicator data and the picture type sequence after change; and compressing the video data to the compressed video data of the picture type sequence after change so that the amount of data after compression becomes substantially the calculated target value.

Brief Summary Text (18):
Note that flatness is defined as an indicator representing a spatial flatness of van image, represents the complexity of the image, and has a correlation with the difficulty (degree of difficulty) of the pattern of the image and the amount of data after compression.

Brief Summary Text (19):
Further, an intra AC is defined as the sum of the dispersion values of the average value of the video data in the pictures and the video data for every DCT block of the DCT processing unit in the MPEG system, represents the complexity of the image, and has a correlation with the difficulty (degree of difficulty) of the pattern of the image and the amount of data after compression similar to the flatness.

Brief Summary Text (20):
Further, an ME residual is defined as the sum of absolute values or the sum of square values of the difference of the video data between the input picture and a reference picture after motion compensation processing by the motion vector at the compression and coding, represents the speed of the motion of the image and the complexity of the pattern, and has a correlation with the difficulty (degree of difficulty) of the pattern of the image and the amount of data after compression similar to the flatness.

Drawing Description Text (3):
FIG. 1 is a view of the configuration of a video data compression apparatus according to the present invention;

Drawing Description Text (6):
FIGS. 4A to 4C are views of an operation of the simplified two pass encoding of the video data compression apparatus according to a first embodiment of the present invention

Drawing Description Text (7):
FIG. 5 is a schematic view of the configuration of the video data compression apparatus according to a second embodiment of the present invention;

Drawing Description Text (8):
FIG. 6 is a detailed view of the configuration of a compression and coding unit of the video data compression apparatus shown in FIG. 5;

Drawing Description Text (9):
FIG. 7 is a view of the correlation between an ME residual and a real difficulty data D.sub.j when producing a P picture by the video data compression apparatus shown in FIG. 1 and FIG. 5;

Drawing Description Text (10):
FIG. 8 is a view of the correlation between the ME residual and the real difficulty data D.sub.j when producing a B picture by the video data compression apparatus shown in FIG. 1 and FIG. 5;

Drawing Description Text (12):
FIG. 10 is a view of the correlation between the flatness and the real difficulty data D.sub.j when producing an I picture by the video data compression apparatus shown in FIG. 1 and FIG. 5;

Drawing Description Text (13):
FIG. 11 is a view of the correlation between the flatness and the real difficulty data D.sub.j when producing an I picture by the video data compression apparatus shown in FIG. 1 and FIG. 5;

Drawing Description Text (14):
FIG. 12 is a view of a compression and coding operation of the video data compression apparatus (FIG. 6) according to a third embodiment of the present invention;

Drawing Description Text (15):
FIG. 13 is a view of the content of the processing of the host computer (FIG. 6) of the video data compression apparatus 2 according to the third embodiment of the present invention;

Drawing Description Text (16):
FIG. 14 is a view of the compression and coding operation of the video data compression apparatus according to a fourth embodiment of the present invention in an order of coding;

Drawing Description Text (18):
FIG. 16 is a flowchart of the content of the processing of the host computer of the video data compression apparatus according to a fourth embodiment of the present invention

Detailed Description Text (4):
If a plurality of video data having a high coding difficulty such as a pattern having a large number of high frequency components or a pattern having a large amount of motion are compressed and coded by a compression and coding system of video data such as the MPEG system generally distortion accompanying the compression is apt to occur. For this reason, it is necessary to compress and code video data having a high difficulty with a low compression rate and allocate a larger target amount of data with respect to the compressed video data obtained by compressing and coding the data having a high difficulty in comparison with compressed video data of video data of a pattern having a low difficulty.

Detailed Description Text (6):
The simplified two pass encoding system indicated as the first embodiment was devised so as to solve the disadvantage of such a two pass encoding system. It can calculate the difficulty of the noncompressed video data from the difficulty data of the compressed video data obtained by preliminarily compressing and coding the noncompressed video data and adaptively control the compression rate of the noncompressed video data delayed by exactly a predetermined time by an FIFO memory or the like based on the difficulty calculated by the preliminary compression and coding.

Detailed Description Text (7):
FIG. 1 is a view of the configuration of a video data compression apparatus 1 according to the present invention.

Detailed Description Text (8):
As shown in FIG. 1, the video data compression apparatus 1 is constituted by a compression and coding unit 10 and a host computer 20. The compression and coding unit 10 is constituted by an encoder control unit 12, a motion detector 14, a simplified two pass processing unit 16, and a second encoder 18. The simplified two pass processing unit 16 is constituted by an FIFO memory 160 and a first encoder 162.

Detailed Description Text (9):
The video data compression apparatus 1 realizes the above simplified two pass encoding with respect to the noncompressed video data VIN input from an external apparatus (not illustrated) such as an editing apparatus and a video tape recorder apparatus by these constituent parts.

Detailed Description Text (10):
In the video data compression apparatus 1, the host computer 20 controls the operation of the constituent parts of the video data compression apparatus 1. Further, the host computer 20 receives the amount of data of the compressed video data generated by preliminarily compressing and coding the noncompressed video data VIN by the encoder 162 of the simplified two pass processing unit 16, the value of the direct current component (DC component) of the video data after the DCT processing, and the power value of the alternating current component (AC component) via a control signal C16 and calculates the difficulty of the pattern of the compressed video data based on these received values. Further, the host computer 20 allocates the target amount of data T.sub.j of the compressed video data generated by the encoder 18 via the control signal C18 for every picture based on the calculated difficulty, sets the same in the quantization circuit 168 (FIG. 3) of the encoder 18, and adaptively controls the compression rate of the encoder 18 in units of pictures.

Detailed Description Text (11):
The encoder control unit 12 notifies the existence of a picture of the noncompressed video data VIN to the host computer 20 and further performs the preprocessing for the compression and coding for every picture of the noncompressed video data VIN. That is, the encoder control unit 12 rearranges the input noncompressed video data in the order of coding, performs picture field transformation, performs 3:2 pull down processing (processing for transforming the video data of 30 frames/sec to video data of 24 frames/sec), etc. when the noncompressed video data VIN is the video data of a movie and outputs the same as the video data S12 to the FIFO memory 160 and the encoder 162 of the simplified two pass processing unit 16.

Detailed Description Text (15):
The encoder 162 is a video data use compression and coding unit constituted by, for example, as shown in FIG. 2, an adder circuit 164, a DCT circuit 166, a quantization circuit (Q) 168, a variable length coding circuit (VLC) 170, an inverse quantization circuit (IQ) 172, an inverse DCT (IDCT) circuit 174, an adder circuit 176, and a motion compensation circuit 178, compresses and codes the input video data S12 by the MPEG system or the like, and outputs the amount of data etc. for every picture of the compressed video data to the host computer 20.

Detailed Description Text (19):
The variable length coding circuit 170 performs variable length coding on the quantized data input from the quantization circuit 168 and outputs the amount of data of the compressed video data obtained as a result of the variable length coding via the control signal C16 to the host computer 20.

Detailed Description Text (25):
As shown in FIG. 3, the encoder 18 is configured as the encoder 162 shown in FIG. 2 plus the quantization control circuit 180. The encoder 18 applies the motion compensation processing, DCT processing, quantization processing, and variable length coding processing with respect to the delayed video data S16 delayed by the amount of L pictures by the FIFO memory 160 by these constituent parts based on the target amount of data T.sub.j set from the host computer 20 to generate the compressed video data VOUT of the MPEG system or the like and outputs the result to an external apparatus (not illustrated).

Detailed Description Text (26):
In the encoder 18, the quantization control circuit 180 successively monitors the amount of data of the compressed video data VOUT output by the variable length quantization circuit 170 and successively adjusts the quantization value Q.sub.j to be set in the quantization circuit 168 so that the amount of data of the compressed video data finally generated from the j-th picture of the delayed video data S16 approaches the target amount of data T.sub.j set from the host computer 20.

Detailed Description Text (27):
Further, the variable length quantization circuit 170 outputs the compressed video data VOUT to the outside and in addition outputs the actual amount of data S.sub.j of the compressed video data VOUT obtained by compressing and coding the delayed video data S16 via the control signal C18 to the host computer 20.

Detailed Description Text (28):
Below, an explanation will be made of the simplified two pass encoding operation of the video data compression apparatus 1 in the first embodiment.

Detailed Description Text (29):
FIGS. 4A to 4C are views of the operation of the simplified two pass encoding of the video data compression apparatus 1 in the first embodiment.

Detailed Description Text (30):
The encoder control unit 12 performs the preprocessing of rearrangement of pictures in the order of coding etc. with respect to the noncompressed video data VIN input to the video data compression apparatus 1, as shown in FIG. 4A, and outputs the same as the video data S12 to the FIFO memory 160 and the encoder 162.

Detailed Description Text (33):
The encoder 162 preliminarily successively compresses and codes the pictures of the input video data S12 and outputs the amount of data of the compressed and coded data obtained by compressing and coding the j (j is an integer)-th picture, the value of the DC component of the video data after the DCT processing, and the power value of the AC component to the host computer 20.

Detailed Description Text (34):
For example, since the delayed video data S16 input to the encoder 18 is delayed by exactly the amount of L pictures by the FIFO memory 160, as shown in FIG. 4B, when the encoder 18 compresses and codes the j (j is an integer)-th picture (picture a of FIG. 4B) of the delayed video data S16, the encoder 162 compresses and codes the (j+L)-th picture (picture b of FIG. 4B) advanced from the j-th picture of the video data S12 by the amount of L pictures. Accordingly, when the encoder 18 starts the compression and coding of the j-th picture of the delayed video data S16, the encoder 162 has completed the compression and coding of the j-th to (j+L-1I)-th pictures (range c of FIG. 4B) of the video data S12, and the real difficulty data D.sub.j, D.sub.j+1, D.sub.+2, . . . , D.sub.j+L-1 after compression and coding of these pictures have been already calculated by the host computer 20.

Detailed Description Text (35):
The host computer 20 calculates the target amount of data T.sub.j to be allocated to the compressed video data obtained by compressing and coding the j-th picture of the delayed video data S16 by the encoder 18 by the following Equation 1 and sets the calculated target amount of data T.sub.j in the quantization control circuit 180. ##EQU1##

Detailed Description Text (36):
Note, in Equation 1, D.sub.j is the real difficulty data of the j-th picture of the video data S12, R'.sub.j is an average of the target amount of data which can be allocated to the j-th to the (j+L-1)-th pictures of the video data S12 and S16, and an initial value (R'.sub.1) of R'.sub.j is the target amount of data which can be allocated to pictures of the compressed video data on the average, represented by following Equation 2, and updated as shown in Equation 3 whenever the encoder 18 generates one picture's worth of the compressed video data.

Detailed Description Text (40):
The variable length coding circuit 170 performs variable length coding on the quantized data of the j-th picture input from the quantization circuit 168 so as to generate the compressed video data VOUT of an amount of data near the target amount of data T.sub.j and outputs the same.

Detailed Description Text (42):
The host computer 20 calculates the target amount of data T.sub.j+1 to be allocated to the compressed video data obtained by compressing and coding the (j+1)-th picture of the delayed video data S16 by the encoder 18 by Equation 1 and sets the same in the quantization control circuit 180 of the encoder 18.

Detailed Description Text (43):
The encoder 18 compresses and codes the (j+1)-th picture based on the target amount of data T.sub.j set in the quantization control circuit 180 from the host computer 20 so as to generate the compressed video data VOUT of an mount of data near the target amount of data T.sub.j+1 and utputs the same.

Detailed Description Text (44):
Further, below, similarly, the video data compression apparatus 1 successively compresses and codes the k-th picture of the delayed video data S16 by changing the quantization value Q.sub.k (k=j+2, j+3, . . .) for every picture and outputs the result as the compressed video data VOUT.

Detailed Description Text (45):
As explained above, according to the video data compression apparatus 1 shown in the first embodiment, the difficulty of the pattern of the noncompressed video data VIN can be calculated in a short time and the noncompressed video data VIN can be adaptively compressed and coded with a compression rate in accordance with the calculated difficulty. That is, according to the video data compression apparatus 1 shown in the first embodiment, the noncompressed video data VIN can be adaptively compressed and coded in almost real time based on the difficulty of the pattern of the noncompressed video data VIN unlike the two pass encoding system, and thus the apparatus can be applied to applications such as live broadcasts in which a real time property is required.

Detailed Description Text (46):
Note that, in addition to that shown in the first embodiment, the data video data compression apparatus 1 according to the present invention can adopt various other configurations, for example, the amount of data of the compressed video data compressed and coded by the encoder 162 may be used as it is as the difficulty data so as to simplify the processing of the host computer 20.

Detailed Description Text (49):
The simplified two pass encoding system shown in the first embodiment is an excellent system capable of performing compression and coding by giving only a delay of about one GOP (for example 0.5 second) to the input noncompressed video data and generating compressed video data of suitable amounts of data.

Detailed Description Text (50):
In this system, however, two encoders are required. In general, an encoder for compressing and coding video data requires large hardware and is very expensive even if formed as an integrated circuit. In addition, it is large in size. Accordingly, the necessity of two encoders in this system prevents a reduction of the cost of the apparatus, a reduction of size, and saving of electric power. Further, it is desirable that the time delay required for the compression and coding be as short as possible, but the processing for calculation of the real difficulty data D.sub.j and the predictive difficulty data D.sub.j ' and the preliminary compression and coding processing per se require a few pictures' worth of processing time, therefore these processings per se become a factor preventing the shortening of the time delay.

Detailed Description Text (51):
The second embodiment was made so as to solve such a disadvantage and provides a video data compression method capable of generating compressed video data of suitable amounts of data equivalent to the simplified two pass encoding system by only using one encoder and in addition requiring a shorter time delay for the processing.

Detailed Description Text (52):
FIG. 5 is a schematic view of the configuration of a video data compression apparatus 2 according to a second embodiment of the present invention.

Detailed Description Text (53):
FIG. 6 is a detailed view of the configuration of a compression and coding unit 24 of the video data compression apparatus 2 shown in FIG. 5.

Detailed Description Text (54):

Note that, in FIG. 5 and FIG. 6, among the constituent parts of the video data compression apparatus 2, the parts the same as the constituent parts of the video data compression apparatus 1 explained in the first embodiment (FIG. 1 and FIG. 2) are indicated by same symbols or numerals.

Detailed Description Text (55):
As shown in FIG. 5, the video data compression apparatus 2 adopts a configuration in which the compression and coding unit 10 of the video data compression apparatus 1 (FIG. 1 and FIG. 2) is replaced by a compression and coding unit 24 obtained by excluding the encoder 162 from the compression and coding unit 10, replacing the encoder control unit 12 by the encoder control unit 22, and adding a buffer memory (buffer) 182.

Detailed Description Text (61):
The video data compression apparatus 2 uses a statistical amount (flatness, intra AC) of the noncompressed video data and the predictive error amount (ME residual) of motion prediction in place of the difficulty of the pattern of the noncompressed video data VIN by these constituent parts, adaptively calculates the target amount of data T.sub.j similar to the video data compression apparatus 1 (FIG. 1 and FIG. 2), and performs high precision feed forward control to compress and code the noncompressed video data VIN to compressed video data of suitable amounts of data.

Detailed Description Text (62):
Note that, in the video data compression apparatus 2, the target amount of data T.sub.j is determined by the motion detector 14 and the statistical amount calculation circuit 224 of the encoder control unit 22 based on the indicator data (parameter) detected in advance. Therefore, below, the compression and coding system in the video data compression apparatus 2 will be referred to as a feed forward rate control (FFRC) system.

Detailed Description Text (63):
Note that, the ME residual is defined as the sum of the absolute values or the sum of the square values of the difference of the video data between pictures to be compressed and a reference picture, is calculated from the pictures which become the P pictures and B pictures after compression by the motion detector 14, represents the speed of the motion of the image and the complexity of the pattern, and has a correlation with the difficulty and the amount of data after compression similar to the flatness.

Detailed Description Text (65):
Further, flatness is a parameter newly defined as an indicator representing the spatial flatness of the image so as to realize the video data compression apparatus 2, indicates the complexity of the video, and has a correlation with the difficulty (degree of difficulty) of the pattern of the image and the amount of data after the compression.

Detailed Description Text (66):
Further, the intra AC is a parameter newly defined as the sum of the dispersion values of the video data for every DCT block of the DCT processing unit in the MPEG system so as to realize the video data compression apparatus 2, indicates the complexity of the image, and has a correlation with the difficulty of the pattern of the image and the amount of data after the compression similar to the flatness.

Detailed Description Text (69):
In order to make the amount of data of the compressed video data generated by the encoder 18 approach the value indicated by the target amount of data T.sub.j, the quantization value Q.sub.j is controlled in the quantization circuit 168 (FIG. 2 and FIG. 6). Accordingly, if a parameter obtained without compressing and coding the video data and adequately indicating the complexity (difficulty) of the video data similar to the real difficulty data D.sub.j can be obtained before the

quantization processing in the quantization circuit 168 of the encoder 18, it would be possible to achieve the objectives of eliminating the encoder 162 (FIG. 1) and shortening the processing delay time. The ME residual, the flatness, and the intra AC have a strong correlation with the real difficulty data D.sub.j and therefore are adequate for achieving these objectives.

Detailed Description Text (72):
FIG. 7 is a view of the correlation between the ME residual and the real difficulty data D.sub.j when generating a P picture by the video data compression apparatuses 1 and 2.

Detailed Description Text (73):
FIG. 8 is a view of the correlation between the ME residual and the real difficulty data D.sub.j when generating a B picture by the video data compression apparatuses 1 and 2.

Detailed Description Text (74):
Note that, in FIG. 7 and FIG. 8, as the real difficulty data D.sub.j, use is made of the amount of data of the compressed video data obtained by compression and coding by using a fixed quantization value by the encoder 18 (below, the same in FIG. 10 and FIG. 11), and FIG. 7 and FIG. 8 are graphs of the relationship between the ME residual and the real difficulty data D.sub.j obtained where standard images ["cheer" (cheer leaders), "mobile" (mobile and calendar), "tennis" (table tennis), and "diva" (diva with noise)] standardized by the CCIR and other images ("resort") are actually compressed and coded by the MPEG system. In FIG. 7 and FIG. 8, an ordinate of the graph (difficulty) indicates the real difficulty data D.sub.j, and abscissa (me resid) indicates the ME residual.

Detailed Description Text (80):
FIG. 10 is a view of the correlation between the flatness and the real difficulty data D.sub.j when generating an I picture by the video data compression apparatuses 1 and 2.

Detailed Description Text (81):
Note that, FIG. 10 is a graph of the relationship between the flatness and the real difficulty data D.sub.j obtained when the standard images standardized by the CCIR and other images are actually compressed and coded by the MPEG system. In FIG. 10, the ordinate of the graph (difficulty) indicates the real difficulty data D.sub.j, and the abscissa (flatness) indicates the flatness.

Detailed Description Text (85):
FIG. 11 is a view of the correlation between the intra AC and real difficulty data D.sub.j when generating an I picture by the video data compression apparatuses 1 and 2.

Detailed Description Text (86):
Note that, FIG. 11 is a graph showing the relationship between the intra AC and the real difficulty data D.sub.j obtained where the standard images standardized by the CCIR and other images are actually compressed and coded by the MPEG system. In FIG. 11, the ordinate of the graph (difficulty) indicates the real difficulty data D.sub.j, and the abscissa (intra AC) indicates the intra AC.

Detailed Description Text (91):
Below, the operation of the video data compression apparatus 2 will be explained by taking as an example a case where the real difficulty data D.sub.j is approximated by the ME residual, the flatness, and the intra AC and the noncompressed video data is compressed and coded by the simplified two pass encoding system.

Detailed Description Text (99):
The variable length coding circuit 170 performs variable length coding on the

quantized data of the j-th picture input from the quantization circuit 168, generates the compressed video data VOUT of an amount of data near the target amount of data T.sub.j, and outputs the same via the buffer memory 182 to an external unit.

Detailed Description Text (100):
Note that, in the TM5 system or the like known as the compression algorithm of the MPEG, to calculate the quantization value of the macroblock (MQUANT), a statistical amount such as the "activity" shown in the following Equation 9 is used. The activity has a strong correlation with the real difficulty data D.sub.j similar to the flatness and the intra AC, therefore it is also possible to constitute the video data compression apparatus 2 so as to perform the compression and coding by approximating the real difficulty data D.sub.j using the activity in place of these parameters. ##EQU3##

Detailed Description Text (105):
Further, while the operation of the video data compression apparatus 2 was explained by taking as an example a case where the simplified two pass encoding shown in the first embodiment was carried out, needless to say the video data compression apparatus 2 can perform the predictive simplified two pass encoding as well.

Detailed Description Text (106):
Further, modifications similar to those with respect to the video data compression apparatus 1 shown in the first embodiment are also possible with respect to the video data compression apparatus 2 shown in the second embodiment.

Detailed Description Text (111):
The processing of the video data compression apparatus 2 in the third embodiment is designed so as to solve such a disadvantage and is enhanced so that the proportional coefficients a.sub.P, a.sub.B, a.sub.I, a.sub.I ', etc. shown in Equation 5 and Equation 6 etc. are adaptively adjusted every moment in accordance with the pattern etc. of the video data so that the real difficulty data D.sub.j can be approximated by the indicator data with a higher precision than that in the second embodiment and compressed video data having a higher quality can be produced.

Detailed Description Text (112):
Below, the processing of the video data compression apparatus 2 in the third embodiment will be briefly explained.

Detailed Description Text (113):
Whenever the encoder 18 of the video data compression apparatus 2 (FIG. 6) ends one picture's worth of compression and coding, the host computer 20 learns one picture's worth of the amount of data of the generated compressed video data and the average value of the quantization values Q.sub.j at the time of the compression and coding and the global complexity explained below can be calculated.

Detailed Description Text (114):
The global complexity is defined as shown in the following Equation 10-1 to Equation 10-3 as a value obtained by multiplying the amount of data of the compressed video data and the quantization value Q.sub.j in TM5 of the MPEG and indicates the complexity of the pattern of the image.

Detailed Description Text (132):
Below, the operation of the video data compression apparatus 2 according to the third embodiment will be explained.

Detailed Description Text (133):
FIG. 12 is a view of the compression and coding operation of the video data

compression apparatus 2 (FIG. 6) in the third embodiment.

Detailed Description Text (141):
The variable length coding circuit 170 performs variable length coding on the quantized data of the j-th picture input from the quantization circuit 168 similar to that in the first embodiment and second embodiment to produce the compressed video data VOUT of an amount of data near the target amount of data T.sub.j and outputs the same via the buffer memory 182.

Detailed Description Text (145):
FIG. 13 is a view of the content of the processing of the host computer 20 (FIG. 6) of the video data compression apparatus 2 in the third embodiment.

Detailed Description Text (156):
Further, modifications similar to those shown in the second embodiment are also possible for the operation of the video data compression apparatus 2 shown in the third embodiment.

Detailed Description Text (157):
As mentioned above, according to the operation of the video data compression apparatus 2 in the third embodiment, the same effect as that by the operation of the video data compression apparatus 2 shown in the second embodiment is obtained and, in addition, a further correct target amount of data T.sub.j than that in the second embodiment can be calculated, and as a result, the quality of the compressed video data can be improved.

Detailed Description Text (160):
Up to here, the explanation was made of the feed forward rate control (FFRC) system for achieving both an improvement of quality of the compressed video data and a real time property of the compression and coding processing by using the indicator data (statistical amount), that is, flatness, intra AC, activity, and ME residual, as the second embodiment and the third embodiment.

Detailed Description Text (161):
In the fourth embodiment, an explanation will be made of a video data compression method (improved FFRC method) using a video data compression apparatus 2 (FIG. 16 and FIG. 17) with which the encoder for obtaining the real difficulty data D.sub.j is unnecessary and in addition the quality of the compressed video data of the border (scene change) part of the video data (scene) contained in the edited video data is not lowered.

Detailed Description Text (163):
However, to determine the existence of a scene change, it is necessary to monitor the change of the indicator data within a range of about 1 GOP in time before and after the scene change part. In the video data compression apparatus 2, the detection of the scene change part becomes possible only after a considerable time has elapsed after the motion detector 14 calculates the indicator data. In actuality, there also exists a possibility that the detection of the scene change part will become possible only immediately before the compression and coding processing in the encoder 18.

Detailed Description Text (165):
The video data compression apparatus 2 in the fourth embodiment provisionally performs the processing for approximation of the real difficulty data D.sub.j by the indicator data or the global complexity in a state where the result of detection of the scene change is not determined, corrects only the part requiring a change along with a scene change in the provisionally calculated real difficulty data D.sub.j after the existence of a scene change and the existence of a change of the picture type sequence are determined, and thereby performs the processing for calculating the target amount of data T.sub.j.

Detailed Description Text (166):
Below, the content of the compression and coding processing of the video data compression apparatus 2 in the fourth embodiment will be explained by taking as an example a case where the picture type sequence with respect to N number of pictures is finally determined whenever the calculation of the ME residuals of N [for simplification of the explanation, below, for example it is assumed that N=L (L is the number of pictures corresponding to the delay time of the FIFO memory 160)] number of pictures is carried out. Note that, the N number of pictures used for the determination of the picture type sequence are the processing units of the processing for determining the picture type sequence and do not always have to coincide with the picture type sequence in the encoder 18. Further, the header does not have to be an I picture unlike the usual GOP. Further, below, one set of such N number of pictures will be also referred to as a rate control GOP (RCGOP).

Detailed Description Text (167):
FIG. 14 is a view of the compression and coding operation of the video data compression apparatus 2 in the fourth embodiment (FIG. 5) in the order of coding.

Detailed Description Text (171):
Whenever the video data compression apparatus 2 (FIG. 5) ends one picture s worth of compression and coding, the host computer 20, similar to that in the second embodiment and the third embodiment, receives as input the flatness, intra AC, and activity calculated by the encoder control unit 22 and the MR residual (statistical amount) calculated by the motion detector 14. The host computer 20 stores these indicator data (FIG. 14A). Further, assuming that no scene change occurs and no change will occur in the picture sequence, the host computer 20 approximates and predicts the real difficulty data D.sub.j in the case assuming that no scene change exists by Equation 12-1 to Equation 12-3 by using the optimized proportional coefficients .epsilon..sup.I, .epsilon..sup.P, and .epsilon..sup.B (Equation 11-1 to Equation 11-3 shown in the third embodiment) similar to that in the third embodiment (FIG. 14B).

Detailed Description Text (172):
Specifically, assuming that the N-th picture from the I picture of the first RCGOP is compressed and coded to an I picture, the pictures of the order of whole multiples of M (n.times.M) are compressed and coded to P pictures, and the pictures other than them are compressed and coded to B pictures, the host computer 20 substitutes the indicator data produced by the pictures to be respectively compressed and coded to an I picture, P picture, and B picture and the proportional coefficients .epsilon..sup.I, .epsilon..sup.P, and .epsilon..sup.B into Equation 12-1 to Equation 12-3 to approximate and calculate the real difficulty data D.sub.j. Note, M indicates the interval of the P pictures in the encoder 18 where there is no scene change.

Detailed Description Text (182):
The variable length coding circuit 170 performs variable length coding similar to that in the first embodiment to the third embodiment, produces the compressed video data VOUT of an amount of data near the target amount of data T.sub.j, and outputs the same via the buffer memory 182.

Detailed Description Text (186):
FIG. 16 is a flowchart of the content of the processing of the host computer 20 in the video data compression apparatus 2 in the fourth embodiment.

Detailed Description Text (194):
The second stage (S420; S422 to S434) is the processing for correcting the real difficulty data D.sub.j predicted at the first stage. At step 422 (S422) of the second stage, the host computer 20 decides whether or not a new RCGOP starts. Where it does not start, the operation routine proceeds to the processing of S430, while

where it starts, the operation routine proceed to the processing of S424.

Detailed Description Text (201):
Note that, in the fourth embodiment, the host computer 20 of the video data compression apparatus 2 performs the processing for correcting only the real difficulty data D.sub.j of pictures changed after compression where there is a scene change, but when there is a room in the processing time, it can be modified so that the real difficulty data D.sub.j of all pictures are calculated after the picture type sequence is decided.

Detailed Description Text (202):
Further, modifications similar to those in the first embodiment to the third embodiment are also possible for the operation of the video data compression apparatus 2 shown in the fourth embodiment.

Detailed Description Text (203):
Further, the contents of the processing of the video data compression apparatuses 1 and 2 respectively explained in the first embodiment to the third embodiment can be combined so far as they do not contradict each other.

Detailed Description Text (204):
As mentioned above, according to the operation of the video data compression apparatus 2 in the fourth embodiment, the same effect as that by the operation of the video data compression apparatus 2 shown in the second embodiment and the third embodiment is obtained, a further correct target amount of data T.sub.j than that in those embodiments can be calculated, and in addition the quality of the compressed video data of the scene change part is not lowered.

Detailed Description Text (205):
As explained above, by the video data compression apparatus according to the present invention and the method of the same, audio and/or video data can be compressed and coded to a predetermined amount of data or less by a method other than the two pass encoding.

Detailed Description Text (206):
Further, by the video data compression apparatus according to the present invention and the method of the same, the video data can be compressed and coded in almost real time and in addition a high quality image can be obtained after expansion and decoding.

Detailed Description Text (207):
Further, by the video data compression apparatus according to the present invention and the method of the same, the compression rate is adjusted by estimating the amount of data after the compression and coding and the compression and coding processing can be carried out by a method other than two pass encoding.

CLAIMS:

1. A video data compression apparatus, comprising:

indicator data calculating means for calculating indicator data indicating a complexity of video data for every picture from non-compressed video data;

target value calculating means for calculating a target value of an amount of data after compression of said video data for every picture based on said calculated indicator data; and

compressing means for compressing said non-compressed video data so that the amount of data after compression becomes said calculated target value, wherein

said compressing means compresses said non-compressed video data to a picture type sequence containing a plurality of types of pictures (I picture, P picture, and B picture, or a combination of them) in a predetermined order,

said indicator data calculating means calculates ME residual data as said indicator data of pictures to be compressed to a P picture and B picture and calculates flatness data and intra AC data or one of the same as said indicator data of a picture to be compressed to an I picture, and

said target value calculating means calculates difficulty data corresponding to the amount of data after compression based on said calculated indicator data and further calculates said target value based on the calculated difficulty data.

2. A video data compression apparatus according to claim 1, wherein:

said indicator data calculating means calculates an activity as the indicator data for compressing said video data to an I picture.

3. A video data compression apparatus according to claim 1 further comprising:

delaying means for delaying said video data for a predetermined time and then outputting same; wherein

said target value calculating means calculates said target value with respect to an output picture outputted by said delaying means based on said indicator data calculated during a period where said delaying means delays said video data, and

said compressing means compresses pictures outputted by said delaying means so that the amount of data after compression becomes said calculated target value.

4. A video data compression method, comprising the steps of:

calculating indicator data indicating a complexity of video data for every picture from non-compressed video data;

calculating a target value of an amount of data after compression of said video data for every picture based on said calculated indicator data; and

compressing said non-compressed video data by a predetermined compression method so that the amount of data after compression becomes said calculated target value, wherein

said compressing step compresses said non-compressed video data to a picture type sequence containing a plurality of types of pictures (I picture, P picture, and B picture, or a combination of the same) in a predetermined order,

said indicator data calculating step calculates ME residual data as said indicator data of pictures to be compressed to a P picture and B picture and calculates flatness data and intra AC data or one of the same as said indicator data of a picture to be compressed to an I picture,

said data amount target value calculating step further has a step for calculating difficulty data corresponding to the amount of data after compression based on said calculated indicator data, and

said target value is calculated based on the calculated difficulty data.

5. A video data compression method according to claim 4, wherein:

said indicator data calculating step calculates an activity as the indicator data

for compressing said video data to an I picture.

6. A video data compression method according to claim 4, further comprising the step of delaying said video data by a predetermined time and outputting same, wherein

said data amount target value calculating step calculates said target value with respect to an output picture delayed and outputted based on said indicator data calculated during a period where said video data is delayed, and

said compression step compresses the output picture so that the amount of data after compression becomes said calculated target value.

7. A video data compression apparatus, comprising:

indicator data calculating means for calculating indicator data indicating a complexity of video data for every picture from non-compressed video data;

difficulty data calculating means for performing a predetermined computation processing for multiplying a coefficient with said calculated indicator data to calculate difficulty data corresponding to an amount of data after compression of said video data for every picture;

target value calculating means for calculating a target value of the amount of data after compression of said video data for every picture based on said calculated difficulty data;

compressing means for compressing each of the pictures of said non-compressed video data by a predetermined compression method so that the amount of data after compression becomes said calculated target value so as to generate compressed video data; and

coefficient updating means for updating said coefficient based on the amount of data of the generated compressed video data, wherein

said compressing means compresses said non-compressed video data to a picture type sequence containing a plurality of types of pictures (I picture, P picture, and B picture, or a combination of the same) in a predetermined order; and

said indicator data calculating means calculates ME residual data as said indicator data of pictures to be compressed to a P picture and B picture and calculates flatness data, intra AC data, and activity or a combination of the same as said indicator data of a picture to be compressed to an I picture.

8. A video data compression apparatus according to claim 7, wherein:

said compressing means has

quantizing means for quantizing said video data by a quantization value set from an external unit so as to generate said compressed video data and

quantization value adjusting and setting means for successively adjusting said quantization value based on said calculated target value and setting the same in said quantizing means; and

said coefficient updating means updates said coefficient based on an average value of said quantization values set in said quantizing means of said compressing means, an amount of data of said generated compressed video data, and said calculated indicator data.

9. A video data compression apparatus according to claim 8, wherein

said coefficient updating means has:

global complexity calculating means for calculating a global complexity based on the average value of said quantization values set in said quantizing means of said compressing means and the amount of data of said generated compressed video data and

coefficient calculating means for calculating said coefficient based on said calculated global complexity and said indicator data.

10. A video data compression apparatus according to claim 9, wherein:

said coefficient calculating means divides the global complexity of a picture which becomes an I picture after compression by said generated flatness, intra AC, or activity to calculate said coefficient for an I picture and divides the global complexity of a picture which become a P picture or a B picture after compression by said generated HE residual to calculate said coefficient for a P picture and said coefficient for a B picture.

11. A video data compression apparatus according to claim 10, wherein:

said coefficient calculating means adds or subtracts a predetermined offset value with respect to said global complexity and divides the result by said generated flatness, intra AC, or activity to calculate said coefficient for an I picture and divides the global complexity of a picture which becomes a P picture or a B picture after compression by said generated HE residual to calculate said coefficient for a P picture and said coefficient for a B picture.

12. A video data compression method, comprising the steps of:

calculating indicator data indicating a complexity of video data for every picture from non-compressed video data;

performing predetermined computation processing for multiplying a coefficient with said calculated indicator data to calculate difficulty data corresponding to an amount of data after compression of said video data for every picture;

calculating a target value of the amount of data after compression of said video data for every picture based on said calculated difficulty data;

compressing each of the pictures of said non-compressed video data by a predetermined compression method so that the amount of data after compression becomes said calculated target value so as to generate compressed video data; and

updating said coefficient based on the amount of data of the generated compressed video data, wherein

said compressing step compresses said non-compressed video data to a picture type sequence containing a plurality of types of pictures (I picture, P picture, and B picture, or a combination of the same) in a predetermined order; and

said indicator data calculating step calculates ME residual data as said indicator data of pictures to be compressed to a P picture and B picture and calculates flatness data, intra AC data, and activity or a combination of the same as said indicator data of a picture to be compressed to an I picture.

13. A video data compression method according to claim 12, wherein:

said compressing step further contains

a step of quantizing the video data subjected to said predetermined compression processing by a quantization value set from an external unit so as to generate said compressed video data and

a step of successively adjusting and setting said quantization value based on said calculated target value; and

said updating step updates said coefficient based on an average value of said adjusted and set quantization values, the amount of data of said generated compressed video data, and said calculated indicator data.

14. A video data compression method according to claim 13, wherein:

said updating step

calculates a global complexity based on the average value of said adjusted and set quantization values and the amount of data of said generated compressed video data and

calculates said coefficient based on said calculated global complexity and said indicator data.

15. A video data compression method according to claim 14, wherein:

said updating step divides the global complexity of a picture which becomes an I picture after compression by said generated flatness, intra AC, or activity to calculate a coefficient for the I picture and divides the global complexity of a picture which becomes a P picture or a B picture after compression by said generated ME residual to calculate said coefficient for a P picture and said coefficient for a B picture.

16. A video data compression method according to claim 15, wherein:

said updating step adds or subtracts a predetermined offset value with respect to said global complexity and divides the result by said generated flatness, intra AC, or activity to calculate said coefficient for an I picture and divides the global complexity of a picture which becomes a P picture or a B picture after compression by said generated ME residual to calculate said coefficient for a P picture and said coefficient for a B picture.

17. A video data compression apparatus for compressing a continuous plurality of video data to compressed video data of a picture type sequence containing a plurality of types of pictures (I picture, P picture, and B picture) in a predetermined order, comprising:

rearranging means for rearranging pictures of said video data to an order adapted to the compression method so that each head picture of said video data becomes an I picture or a P picture;

indicator data calculating means for calculating indicator data indicating a complexity of said rearranged video data for every picture;

border detecting means for detecting a scene change of a continuous plurality of said video data;

changing means for changing said picture type sequence so that a picture of any of said video data are compressed without reference to a picture of other video data for every border of a detected scene change;

target value calculating means for calculating a target value of the amount of data after compression of said video data based on said calculated indicator data and said picture type sequence after change; and

compressing means for compressing said video data to compressed video data of said picture type sequence after change so that the amount of data after compression becomes substantially said calculated target value, wherein

said target value calculating means has

approximating means for performing predetermined computation processing for multiplying a coefficient with said calculated indicator data to calculate difficulty data corresponding to the amount of data after compression and

calculating means for calculating a target of the amount of data after compression of said video data for every picture based on said calculated difficulty data, and

said compressing means has

quantizing means for quantizing said video data by a quantization value set from an external unit so as to generate said compressed video data and

quantization value adjusting and setting means for successively adjusting said quantization values based on said calculated target value and setting the same in said quantizing means; said video data compression apparatus further comprising

coefficient updating means for updating said coefficient based on the average value of said quantization values set in said quantizing means of said compressing means, the amount of data of said generated compressed video data, and said calculated indicator data.

18. A video data compression apparatus according to claim 17, wherein

said target value calculating means has:

predictive target amount calculating means for calculating said target value in accordance with the type of picture after compression by predicting that pictures contained in the predetermined compression unit are compressed as an order of said picture type sequence in advance before the change of said picture type sequence and

target amount correcting means for correcting said target value of a picture of said video data of a type of picture which after compression is changed in accordance with the type of the picture after the change in only a case where a change of said picture type sequence actually exists.

19. A video data compression apparatus according to claim 18, wherein:

said indicator data calculating means calculates the flatness, intra AC, and activity as indicator data of a picture which becomes an I picture after compression and the ME residual as indicator data of a picture which becomes a P picture or a B picture after compression;

said changing means changes said picture type sequence so that the picture of the head of said video data is compressed to an I picture when the picture of the head of said video data would be compressed to a P picture; and

said target amount correcting means corrects said target value of a picture of a type of picture after compression which changes from a P picture to an I picture,

which is calculated in advance, to said target amount of a picture in a case where it becomes an I picture after compression and corrects said target value of a picture of a type of the picture after compression which changes from an I picture to a P picture, which is calculated in advance, to said target amount of a picture in a case where it becomes a P picture after compression.

20. A video data compression apparatus according to claim 17, wherein

said coefficient updating means has

global complexity calculating means for calculating a global complexity based on an average value of said quantization values set in said quantizing means of said compressing means and the amount of data of said generated compressed video data and

coefficient calculating means for calculating a coefficient based on said calculated global complexity and said indicator data.

21. A video data compression apparatus according to claim 20, wherein:

said coefficient calculating means divides a global complexity of a picture which becomes an I picture after compression by said generated flatness, intra AC, or activity to calculate a coefficient for an I picture and divides a global complexity of a picture which becomes a P picture or a B picture after compression by said generated ME residual to calculate a coefficient for a P picture or a coefficient for a B picture.

22. A video data compression method for compressing a continuous plurality of video data to compressed video data of a picture type sequence containing a plurality of types of pictures (I picture, P picture, and B picture) in a predetermined order, comprising the steps of:

rearranging pictures of said video data to an order adapted to the compression method so that each head picture of said video data becomes an I picture or a P picture;

calculating indicator data indicating a complexity of said rearranged video data for every picture;

detecting a scene change of a continuous plurality of said video data;

changing said picture type sequence so that a picture of any of said video data is compressed without reference to a picture of other video data for every border of a detected scene change;

calculating a target value of the amount of data after compression of said video data based on said calculated indicator data and said picture type sequence after change; and

compressing said video data to compressed video data of said picture type sequence after change so that the amount of data after compression becomes substantially said calculated target value, wherein

said target value calculating step performs predetermined computation processing for multiplying a coefficient with said calculated indicator data so as to calculate difficulty data corresponding to the amount of data after compression and

calculates a target of the amount of data after compression of said video data for every picture based on said calculated difficulty data,

said compressing step quantizes video data subjected to said predetermined compression processing by a quantization value set from an external unit so as to generate said compressed video data and

successively adjusts said quantization value based on said calculated target value and sets the same, and

said predetermined coefficient is updated based on the average value of said set quantization values, the amount of data of said generated compressed video data, and said calculated indicator data.

23. A video data compression method according to claim 22, wherein

said target value calculating step calculates said target value in accordance with the type of picture after compression by predicting that pictures contained in said predetermined compression unit are compressed as an order of said picture type sequence in advance before the change of said picture type sequence and

corrects said target value of the picture of said noncompressed video data of a type of picture which after compression is changed in accordance with the type of the picture after the change in only a case where a change of said picture type sequence actually exists.

24. A video data compression method according to claim 23, wherein:

said indicator data calculating step calculates a flatness, intra AC, and activity as indicator data of a picture which becomes an I picture after compression and an ME residual as indicator data of a picture which becomes a P picture or a B picture after compression;

changes said picture type sequence so that the picture of the head of said video data is compressed to an I picture where the picture of the head of said video data would be compressed to a P picture; and

corrects said target value of a picture of a type of picture after compression which is changed from a P picture to an I picture, which is calculated in advance, to said target amount of a picture in the case where it becomes an I picture after compression and corrects said target value of a picture of a type of picture after compression which is changed from an I picture to a P picture, which is calculated in advance, to said target amount of a picture in the case where it becomes a P picture after compression.

25. A video data compression method according to claim 22, wherein

said coefficient updating step calculates a global complexity based on the average value of said quantization values to be set and the amount of data of said generated compressed video data and

calculates said coefficient based on said calculated global complexity and said indicator data.

26. A video data compression method according to claim 25, wherein:

said coefficient calculating step divides a global complexity of a picture which becomes an I picture after compression by said generated flatness, intra AC, or activity to calculate said coefficient for an I picture and divides a global complexity of a picture which becomes a P picture or a B picture after compression by said generated ME residual to calculate said coefficient for a P picture or said coefficient for a B picture.

L5: Entry 11 of 22 File: USPT Mar 27, 2001

DOCUMENT-IDENTIFIER: US RE37112 E
TITLE: Image signal recording and reproducing system with use of bandwidth compression coding

Abstract Text (1):
A recording and reproducing system for digitizing the image signal and compression coding the signal by in-field and inter-field, or in-frame and inter-frame coding, wherein the inter-field or inter-frame coding is used as the primary coding method, in field or in-frame coding is applied at a regular interval, and when scene changes are detected, in-field or in-frame coding is mandatorily applied to the field or frame immediately after the scene change. Furthermore, a new in-field or in-frame coding cycle is started at the field or frame immediately after the scene change to absorb the increased information resulting from in-field or in-frame coding by increasing the compression ratio of the inter-field or inter-frame coding means within the period to the next in-field or in-frame coded field or frame. The generation of additional information is further reduced and the increase in information produced by the field or frame immediately after the scene change is absorbed by a data substitution, specifically by absorbing the increase in information generated by the field or frame immediately after the scene change by using the same data as that of the immediately preceding field or frame for the field or frame immediately before or after the scene change.

Brief Summary Text (3):
The present invention relates to a signal processing method for bandwidth compression coding of an image signal, and to a recording and reproducing device for recording this information to a recording medium such as an optical disk or a video tape and reproducing the information from this medium.

Brief Summary Text (5):
Known image signal compression coding methods include in-field, in-frame, inter-field, and inter-frame. Inter-field and inter-frame coding use the correlation between the current field or frame and the fields or frames chronologically before and after the current field or frame to achieve a generally high compression ratio compared with in-field or in-frame compression coding, but requires in-frame or in-field coding to refresh the signal at a regular period because errors, when they occur, are propagated along the time axis.

Brief Summary Text (6):
During scene changes, however, when there is a significant change in the image, there is no time axis correlation between the adjacent fields or frames. Inter-field or inter-frame coding is therefore meaningless, and can actually result in image deterioration under certain circumstances.

Brief Summary Text (7):
Furthermore, the total amount of compression coded information increases and the effective compression ratio therefore decreases when in-field or in-frame coding is extensively used.

Brief Summary Text (9):
The present invention is a signal processing method and recording and reproducing

means which digitize an image signal and code the digitized signal by singular or plural in-field, in-frame, inter-field, and inter-frame means. The inter-field or inter-frame coding means is the primary coding device. In-field or in-frame coding is applied at a regular interval to the inter-field or inter-frame coded signal sequence, scene changes are detected and in-field or in-frame coding is mandatorily applied to the field or frame immediately following the scene change, and this field or frame becomes the starting field or frame for the in-field or in-frame coding applied at a regular interval thereafter. The increased data quantity resulting from in-field or frame compression coding is thus compensated for by increasing the compression ratio of the inter-field or inter-frame compression coding means during the regular interval between in-field or frame coding.

Brief Summary Text (10):
The invention is further comprised to absorb the increase in information generated by the field or frame immediately after the scene change by mandatorily coding the field or frame immediately after a scene change by the in-field or in-frame coding means using the same data as that of the immediately preceding field or frame for the field or frame immediately before or after the scene change.

Brief Summary Text (11):
Thus, the field or frame immediately after the scene change is efficiently coded, and the total amount of information produced is not increased.

Detailed Description Text (3):
The coding circuit 1 digitizes the image signal and compression codes the signal by means of in-field, in-frame, inter-field, and inter-frame coding used singularly or in combination. The scene change detection circuit 2 detects scene changes. The recording circuit 3 converts the output of the coding circuit 1 to a recording signal. The recording/reproducing head 4 records the output of the recording circuit 3 to the recording medium 5, or as shown in FIG. 3, reproduces the recorded information from the recording medium 5.

Detailed Description Text (4):
In the operation of this device the image signal is primarily compressed by inter-field or inter-frame coding with in-field or in-frame coding applied at a regular interval. Scene changes are detected, and in-field or in-frame coding is mandatorily applied to the field or frame immediately after the scene change. The information is then recorded to the recording medium, or is reproduced therefrom.

Detailed Description Text (13):
It is therefore necessary to reduce the amount of information. A first method to accomplish this is illustrated in FIG. 2 (C). In this method, the amount of information is reduced by reducing the compression ratio to 0.8 to 0.9 from the conventional value of 1 in the inter-frame coded frames 6-12 between the frame 5 mandatorily compressed by in-frame coding due to the scene change immediately therebefore, and frame 13 at the end of the new cycle starting at frame 5. This conforms with the tendency of errors in the frame immediately after a scene change to be difficult to distinguish visually. It is therefore possible to reduce the total data quantity by an amount approximately equal to K.

Detailed Description Text (18):
Furthermore, it should be noted that while the invention was described above with specific reference to in-frame and inter-frame processing, the invention shall not be thus limited and the same effect is obtained by in-field and inter-field processing. Furthermore, inter-frame or inter-field processing can also be applied with data interpolated from the fields or frames before and after the current compression field or frame.

Detailed Description Text (20):
Moreover, it is necessary to distinguish those frames in which in-frame compression

coding was applied at a regular interval and was applied mandatorily due to a scene change. The decoding operation can be greatly simplified in this case by outputting or recording the data with an added bit set HIGH or LOW at a predetermined position in the frame immediately after the scene change.

Other Reference Publication (1):

Artieri, Alain and Colavin, Oswald, "A Chip Set Core for Image Compression," IEEE on Consumer Electronics, vol. 36, No. 3, pp. 395-402 (Aug. 1990).

CLAIMS:

2. The signal processing system according to claim 1 wherein a new cycle of said intra-unit coding means is started from a unit immediately after the scene change is detected.